is 42. Jackson (1959) has reported a gametic chromosome number of 24 for *Z. grandiflora*. The rays of *Z. acerosa* are white (drying pale yellow), generally fewer, slightly larger and the disk is reddish. Populations having gametic chromosome numbers of 10, 19, and 20 have been found. Voucher herbarium specimens for the chromosome counts are deposited at Indiana University.

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LITERATURE CITED

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A COMMENT ON COLD SUSCEPTIBILITY OF PONDEROSA AND JEFFREY PINES

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Dr. Haller's recent paper[2] on factors affecting the distribution of ponderosa and Jeffrey pines prompts a supplementary note concerning the comparative effects of low temperatures observed on the two species in northeastern California. In this region extensive mixed stands of the two occur, many of them above the 5,000-foot level, providing a convenient comparison of their reactions to environmental conditions for the geographical races represented there.

Dr. Haller considers that *Pinus jeffreyi* is more tolerant than *P. ponderosa* of extremes of low temperature and aridity, but he concludes that the differential limiting effect of low temperature must be exerted in the seedling stage or on young trees because mature trees of *P. ponderosa* at its upper altitudinal limit appear vigorous and show no evidence of stunting. My observations over the past 25 years, following periods of severe cold, fail to indicate any material difference between the two species in their ability to withstand extreme cold, either as young or mature trees.

In January 1937, California experienced two very cold periods, particularly east of the Sierra Nevada crest. The first of these was from January 8 to 10 and the second from January 20 to 25. The lowest temperature reported to the United States Weather Bureau for these periods in California was −45°F. at Boca, California, on January 20.

Early in February a belt of pronounced damage to pines and other vegetation became noticeable along the east face of the Sierra Nevada for almost its entire length. At the north end it was narrow, from 25 to

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[2] Haller, John R. Factors affecting the distribution of ponderosa and Jeffrey pines in California. Madroño 15:65–71. 1959.

200 yards wide, depending on slope, and occurred at an elevation of about 4,800 feet. Toward the south the belt was wider and was located at a gradually increasing elevation, between 7,000 and 8,000 feet at the south end.

From the Truckee River southward the damage to pines consisted largely of foliage browning, from which practically all the trees later recovered. On the slope above Long Valley Creek, Lassen County, however, damage was much more pronounced, and many mature pines, as well as trees of younger ages, failed to recover. Mortality in the pines ran as high as 75 percent.

In the topographic gap created by the Susan River the belt-like character of the zone of damage was less evident but the major injury was found at approximately the same elevation as above Long Valley Creek. A strong temperature inversion apparently occurred at this level. On low benches along the Susan River a number of cases were observed where the lower foliage of young Jeffrey pines 20 to 30 feet in height was almost completely killed, whereas that of the upper crowns on the same trees was only slightly damaged. In addition, many of the trees showed browning of the phloem tissues of the inner bark of the lower trunks and branches. Most of these trees died later. The immediate cause of death appeared to be the activities of bark insects attracted by the killed phloem. Whether the trees could have survived in the absence of the insects was not determined.

In Jeffrey pine the spread between noticeable injury to foliage and the complete killing of foliage and branches or trunks appeared to be very much narrower than in ponderosa pine. Cases were noted in which foliage on ponderosa pines was almost completely killed, but nearly all buds and twigs remained alive and produced fairly good growth the following season. This was not true for Jeffrey pines. In them, severe foliage injury was accompanied by severe bark injury, and no recovery followed. Where both species were present in the same location there was less mortality in the ponderosa than in the Jeffrey pines.

Another series of abnormally low temperatures prevailed in California in January, 1949. Minima of −38°F. were registered at Boca, California, on the 25th and of −31°F. at Alturas and Bridgeport Dam on the 26th.

Damage to pines on low ground east of the Sierra Nevada as a result of this series of cold waves during the month was much more general in occurrence than in 1937. Heavy browning of foliage of young ponderosa and Jeffrey pines on the borders of low flats or along stream bottoms was noted in interior basin drainages from Modoc County to the San Bernardino Mountains. Stringers of pines along stream courses extending into the Honey Lake and Carson valleys were heavily damaged, and many trees eighteen to twenty inches in diameter breast high later succumbed. These were mostly Jeffrey pines but some ponderosa pines were present also. Mortality in them appeared to be no greater in proportion than in the Jeffrey. Recovery in young trees appeared to depend on whether or not the inner bark tissues of the main stem had been injured. Killing of these tissues was found both in ponderosa and Jeffrey pines, with later mortality after the stems had been invaded by bark-feeding insects.

Neither in 1937 nor in 1949 was enough difference in mortality from the abnormal cold noted between established trees of the two species to account for the tendency of Jeffrey pine to be confined to the higher elevations or colder situations. If an ecologically significant difference exists between the two with respect to cold tolerance it must be operative in the seedling stage, as Haller suggests, or through some other influence than differential mortality from cold.

DOCUMENTED CHROMOSOME NUMBERS OF PLANTS

(See MADROÑO 9:257–258. 1948)

Species	Number	Counted by	Collection	Locality
RANUNCULACEAE				
Delphinium carolinianum Walter	n = 8	B. L. Turner, TEX[1]	*Thompson & Turner 96* TEX	Hardin County, Texas
virescens var. *macroceratilis* (Rydb.) Ewan	n = 8	B. L. Turner, TEX	*Turner 4395* TEX	Bexar County, Texas
SAXIFRAGACEAE				
Saxifraga ferruginea Graham	n = 19	K. I. Beamish, UBC	*Beamish 7828* UBC	Mt. Seymour near Vancouver, B.C., Canada
			Beamish 9000 UBC	Caulfeilds, near Vancouver, B.C., Canada
integrifolia Hook.	n = 19	K. I. Beamish, UBC	*Beamish 7057* UBC	Thetis Lake, Vancouver Island, B.C., Canada
			Beamish, Vrugtman & Sparling 8017 UBC	Elk Falls, Vancouver Island, B.C., Canada
montanensis Small	n = 19	K. I. Beamish, UBC	*Vrugtman, Beamish & Kallio 9027* UBC	Princeton-Merritt Road, B.C., Canada
occidentalis Watson sensu lat.	n = 19	K. I. Beamish, UBC	*Beamish, Vrugtman & Sperrings 8224,* UBC	Botanie Valley, near Lytton, B.C., Canada

[1] Symbols for institutions are those listed by Lanjouw and Stafleu. Index Herbariorum, Part I. Second edition, 1954, Utrecht.